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Joint Light Tactical Vehicle: A Case Study

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Abstract

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The Joint Light Tactical Vehicle (JLTV) is the Army and Marine Corps' partial fleet replacement solution for the aging High-Mobility, Multipurpose Wheeled Vehicle (HMMWV). Until recently, JLTV was viewed as a materiel solution that might never come to fruition amidst significant challenges in meeting requirements necessary to advance as a formal program of record. The JLTV materiel solution achieved Program of Record status on 5 January 2012 and is well positioned to meet the next set of requirements in advance of the next phase in program development. This Civilian Research Project examines the JLTV program from requirements development through its current state at the beginning of the Engineering and Manufacturing Development Phase. This paper includes a thorough exploration of requirements generation and program scope. It also includes observations concerning the circumstances and actions taken throughout the process that not only spawned great achievement, but also nearly drove the program to extinction. The ensuing results of the analysis and observations may further identify successes and best practices that may be applied to future programs.

Joint Light Tactical Vehicle: A Case Study

The Joint Light Tactical Vehicle (JLTV) is the Army and Marine Corps' partial fleet replacement solution for the aging High-Mobility, Multipurpose Wheeled Vehicle (HMMWV). Until recently, JLTV was viewed as a materiel solution that might never have come to fruition amidst significant challenges in meeting requirements necessary to advance as a formal Program of Record. Requirements varied greatly in the categories of protection, weight-range and reliability over the life of the program. Cost estimates fluctuated up and down with the changes in requirements from an initial estimated Average Unit Manufacturing Cost (AUMC) of $200,000 per vehicle, up to a high of $400,000, then down to its current AUMC of $250,000. The JLTV materiel solution achieved Program of Record status on January 5, 2012 and is well positioned to meet the next set of requirements in advance of the next phase in program development. The most important issues to understand are how seemingly unstable requirements and the definition of affordability, which changed over time, eroded much-needed support from our senior leaders and elected officials, and what steps were taken to achieve affordable cost targets for the Engineering and Manufacturing Development phase (EMD) to restore full confidence and support for the JLTV program.[1]

Light Tactical Vehicle Background

Over the past 20 years, the purpose and use of the Army's tactical wheeled vehicles have dramatically changed. Originally designed as a thin-skinned vehicle, deployed primarily in a logistics centric role, behind what was once considered the forward line of troops on a linear battlefield, is now an armored vehicle, required to

survive in an ever-increasing threat environment in both a logistics and weapons - carrying platform role. Significant leaps in technology and protection have greatly increased the cost of the tactical wheeled vehicle fleet. In the case of the HMMWV, the AUMC increased from an initial cost of $70,000 for the base vehicle at its highest point to over $220,000 fully loaded with armor kits.[2] The HMMWV, and later, the Mine-Resistant, Ambush-Protected (MRAP) vehicle provided the Army with armored vehicles for the current threat environment.

The Army, as is true with ground components of the other Services, has a strategy for its tactical wheeled vehicle fleet. A review of the Light Tactical vehicle class and the associated strategy will provide the background necessary to understand where the JLTV program encountered difficulties and how issues were solved.

The HMMWV has been the Army's light tactical vehicle workhorse since 1985. It was designed to replace the vehicles that only some may remember such as the ¼ ton Jeep and the Gamma Goat. Its beginnings reach back to 1979 when the U.S. Army published requirements for the development of a new light tactical vehicle. The Army issued development contracts to three companies, AM General, Chrysler Defense and Teledyne Continental to produce 11 prototype vehicles for testing over the following 24 months. In 1981 the Army conducted a down-select competition and awarded AM General a contract for additional prototype vehicles to perform developmental and operational testing. In 1983, AM General was awarded a $1.2 billion dollar contract for 55,000 HMMWVs, 39,000 of which were for the Army with deliveries beginning in 1985.[3]

The HMMWV underwent many upgrades in its 27 years of service. The Gulf War in 1991 spurred the development and fielding of the M1109 Armored Armament Carrier

HMMWV. It featured increased protection to the underbody and side-body of the vehicle and was used in peacekeeping operations in Somalia in1994.[4] Following the attacks on the United States in September of 2001, the United States entered into Operation Enduring Freedom in Afghanistan, which would be the beginning of 12 years of continuous combat. In support of initial operations, the United States forces deployed with a relatively new wheeled vehicle fleet, however insufficient, including just 51 of the newly developed M1114 Up-Armored HMMWV (UAH) that was built based upon lessons learned from operations in Somalia. It was also deployed to Haiti, Kosovo, the Balkans and Bosnia with a high degree of effectiveness.[5]

The Improvised Explosive Device (IED) began appearing on the battlefield in Iraq in June 2003. They proved to be decidedly effective against the thin-skinned vehicles and the UAH. In mid 2003, there were as few as 22 IED strikes per month. Combat operations continued to escalate, and only one year later, in June 2004, the United States and its coalition forces were suffering over 600 IED strikes per month. Not only were the numbers of strikes increasing, but the lethality and sophistication of the devices were also increasing. Once the Army deployed into Iraq in 2003, the Army began retrofitting soft skinned vehicles with armor kits. According to the government accountability office (GAO), by late 2006, IED strikes were well over 2000 per month. This equated to approximately 67 IED strikes per day against the United States and coalition forces.[6]

During the course of the War on Terrorism, multiple improvements were made to the HMMWV, and the UAH was being procured in greater numbers. Additionally, fragmentary armor kits were being developed as supplemental protection that could be

retrofitted to vehicles already in service and deployed. The different levels of armor, referred to as Frag Kits, provided supplemental armor for the vehicle beginning with level I and ending at level VII. With all levels integrated, the armor kits were marginally successful in providing increased protection to the vehicle occupants, and ultimately proved to be insufficient for the increasing threat and changing lethality of the IED.[7] The efforts to improve the HMMWV culminated with the most capable combat vehicles to date, the M1151 Expanded Capacity (EC) Armament Carrier and the M1165A1EC C2/GP vehicles that are still in service today.[8] Unfortunately, the extensive upgrades to the up-armored HMMWV would ultimately prove deficient as the IED threat shifted from side attack explosives to a buried IED threat, rendering the battle tested vehicle that had proved very effective against the early threat tactics unsuitable for off-FOB operations.[9] Commanders in the field were calling for vehicles with even more protection to address the underbody and increasingly lethal threat of explosively formed penetrators.

On February 17, 2005, the first formal request for the Mine-Resistant, Ambush-Protected (MRAP) vehicles was submitted in the form of an Urgent Universal Needs Statement by the Deputy Commanding General, 1st Marine Expeditionary Force. It was clear to the Marine Corps leadership that that their Marines needed more survivable vehicles than those with which they had deployed. Then, in an unexpected turn of events, the Marine Corps Combat Development Command (MCCDC) halted the request process for MRAPs, and instead opted to replace the thin-skinned HMMWV with the less costly M1114 UAH.[10] That decision proved to be an inadequate solution to the immediate problem.

Again, the proliferation of IED use was increasing at an alarming rate. The effects of the IED were so lethal, violent and heavily reported in the media that immediate action had to be taken.[11]

The MRAP had already gained notoriety as far back in the war as 2003. Both the Army and the Marines were already using a very small number of MRAPs in Iraq and Afghanistan. MRAP-like vehicles, commonly referred to as Route Clearance Vehicles (RCV) were used to conduct route clearance missions, which allowed for significantly safer freedom of movement in both theaters of operation. They were also used by explosive ordnance disposal units to clear and reduce unexploded ordinance and explosive hazards. The MRAP program was designed to be executed quickly relative to the normal defense acquisition process. In fact, the Secretary of Defense Robert Gates designated the program the number one acquisition priority for the Department of Defense.[12]

In May 2006, the commanding general of multinational forces West (MNF-W) in Iraq, submitted the first official request for 185 MRAPs using the Joint Universal Operational Needs Statement (JUONS). Two months later, in July of 2006, the Marines updated the request for a total of 1185 MRAPs. The requirement for MRAPs was so urgent, that in only four months' time (Nov 06), a sole source contract was signed for MRAP production with Force Protection Industries (FPI).[13]

Between May 2006 and May 2007, MRAP requirements for the entire DoD had increased 15%. As casualties resulting from IED strikes were peaking, US Army commanders were unrelenting in their requests for the MRAP. While back in February 2007 Army leaders had decided to primarily remain reliant upon the UAH for combat

operations, with a far lesser number of MRAPs as a supplement, they were now contemplating replacing all HMMWVs in theater with MRAPs on a one-for-one basis.[14]

The Joint Requirements Oversight Council (JROC) is the DoD organization that provides oversight to joint acquisition programs. One of its functions is to provide recommendations to the Defense Acquisition Board on programs that are considered high interest. The MRAP program was certainly of high interest according to Secretary of Defense Gates. The JROC was paying strict attention to the progress of MRAP requirements determination and on June 28, 2007, the committee concurred with established requirements and recommended the replacement of all HMMWVs in theater with MRAPs.[15]

From a strategic perspective, the Department of the Army was well positioned in terms of its budget authority and a path to achieve the greater levels of protection demanded by conditions on the ground in both theaters of operation. The annual budget was on its normal glide path of automatic increases year over year. They had grown accustomed to additional wartime support from Congress referred to as Global War on Terror (GWOT) funding. GWOT funds allowed the United States to provide the best training and equipment available to the most capable military in the world. The JROC's endorsement of the one-for-one replacement of HMMWVs with MRAPs necessarily caused the Army to adjust its Tactical Wheeled Vehicle Strategy. This strategy is the document that defines the way in which the Army equips its forces with tactical wheeled vehicles for up to 20 years.[16]

Army Tactical Wheeled Vehicle Strategy

In 2006, the Tactical Wheeled Vehicle Strategy was centered on the current fleet of 235,000 trucks. Having been involved in persistent combat since 2001, the Army's fleet of tactical wheeled vehicles was suffering considerably from the wear and tear of combat operations. The continuous use of equipment at a high operational tempo disclosed shortcomings in the current fleet, particularly among the "ilities," such as survivability, reliability and maintainability. The 2006 Tactical Wheeled Vehicle Strategy was amended to include both recapitalization and modernization.[17]

The improved Tactical Wheeled Vehicle Strategy purported what Scott R. Gourley referred to, in an Army Magazine article, as a balancing of three competing components in the strategy. The first component was modularity. Modularity was the plan born around 2004 to transform the Army's formations from a division-type organizational structure to a modular-type structure focused on the brigade. The modularity construct provided commanders more flexibility in the form of plug and play units that could be configured to support almost any tactical contingency. The second component was future fleet capabilities. It was clear that the role of the tactical wheeled vehicle had dramatically changed, and a focus on future requirements and capabilities was necessary. The third component was supporting current operations with the existing fleet. The strategy required supporting the war fighter in its current environment, providing vital vehicular upgraded capabilities such as protection, while again looking for long-term solutions to future requirements.[18]

In 2010, the Army published its Tactical Wheeled Vehicle Strategy that was well-informed by the current state of the economy and a growing trend in decreasing

budgets. It was clear that the tactical wheeled vehicle fleet needed to be improved upon, but all improvements had to be affordable. The current fleet consists of the light, medium, heavy, and MRAP classes of vehicles. While the HMMWV has been improved, it still does not meet requirements for protection or mobility. The Army has invested a considerable amount of money on its tactical wheeled vehicle fleet over the past 10 years. Between 2003 and 2013, the Army spent an average of $6 billion per year. That illustrates the effect that long periods of combat have on vehicles, as the Army spent, on average, less than $1 billion per year between 1997 and 2003.[19]

Modernization and recapitalization of the fleet will be costly, and tough decisions have been made in order to accomplish this. Those decisions include adjusting the on-hand quantities and the level of modernization between the Army's Active Component, the U.S. Army Reserve and the Army National Guard. Historically, the results have not been popular with all Army components, but were certainly necessary. Projections of future budgets indicate that after 2014 annual spending on the next vehicle fleet will amount to approximately $1 billion per year in the short term, increasing to a steady-state of approximately $2.5 billion per year shortly thereafter.[20]

The JLTV Program

History

Both the Army and the Marine Corps recognized the urgent need for a more capable replacement for the HMMV. As a result, the JROC approved the JLTV program in November 2006. That action began a 13-month long Concept Refinement phase. The Concept Refinement phase is a pre-systems acquisition process designed to further

develop the initial concepts resident in the Initial Capabilities Document (ICD) and also includes an Analysis of Alternatives (AoA). At the successful conclusion of the Concept Refinement phase in December 2007, the Joint Program Office (JPO) JLTV Project Manager (PM) fully intended to transition the program directly into the Engineering, Manufacturing, and Development (EMD) phase as planned. He initiated the steps necessary to enter the acquisition process directly at Milestone B, as is customary following the successful completion of the TD phase. However, as the calendar date for the milestone approached, it became clear that the Milestone Decision Authority (MDA), Defense Acquisition Executive (DAE), John Young, would not support the JLTV program entering into the acquisition process at Milestone B quite yet. Instead, he denied the request and instructed the Army and the Marine Corps to develop a more vigorous TD phase. Mr. Young's concerns were threefold. First, he was not convinced that the technology required was mature enough. Second, he believed that requirements were not stabilized, and last, a potential lack of adequate funding still existed. Understanding the task given them by the DAE, the Services complied, the request was subsequently approved and on February 5, 2008, and the RFP was in fact published. [21]

During the TD phase, the JPO JLTV awarded three competitively bid contracts for each of the contractors to build seven prototype vehicles, including four trailers. The winners included BAE System's Land and Armament Systems, General Tactical Vehicle and Lockheed Martin. The TD phase lasted 27 months and in May 2011 it was completed. [22] At the end of the TD phase, the government's industry partners delivered

vehicles with mature and integrated technologies, including a validated set of requirements at a cost that still required refinement.

On September 13, 2011, the Defense Subcommittee of the Senate Appropriations Committee threatened to terminate the JLTV program due to what they considered excessive cost growth and unstable requirements. It was clear that the AUMC was well above $300,000 per vehicle, which was still considered by many to be too high. The Senate's concerns over requirements were due to conflicting requirements of the two Services involved. The Army's mission set required or allowed for a slightly heavier vehicle, while the Marine Corps had requirements that reflected a more expeditionary or lighter weight requirement. In addition to an effort to stay within costs and stabilize requirements, it appeared that senior-level military leadership involvement satisfied the concerns of our elected officials. As such, funding for the JLTV program was reinstated in October 2011.[23]

On August 9, 2012 the Defense Acquisition Board (DAB), led by Mr. Frank Kendall met to consider the request for a favorable Milestone B decision and entry into the EMD phase. The Acquisition Decision Memorandum approving Milestone B entry into the EMD phase was published on August 20, 2012. On August 23, 2012, JPO JLTV awarded AM General, Oshkosh Defense and Lockheed Martin teamed with BAE three contracts worth a total of $187 million to participate in the 33 month long EMD phase. It is important to note that the contract portion of the EMD phase is only 27 months, while the entire phase is 33 months long. The differential in the schedule was programmed to ensure the successful transition from Milestone B to Milestone C. The winners of the competition were now bound to deliver 22 prototype test vehicles no later than October

2013. The program will include a total of approximately 48,000 vehicles for the Army and 5,500 for the Marine Corps. [24]

System Description

The JLTV Family of Vehicles (FoV) consists of two armor protected variants. The first is a two-seat variant and the second variant is a four seat vehicle, as seen in Figure 1 below. The two-seat variant has but one base vehicle platform which is Utility. It may be configured to carry small quantities of cargo, a mounted shelter, or even serve as a prime mover for towed howitzers. The four-seat variant, however, has two base vehicle platforms. The first is a General Purpose (GP) vehicle and the second is a Close Combat Weapons Carrier (CCWC).

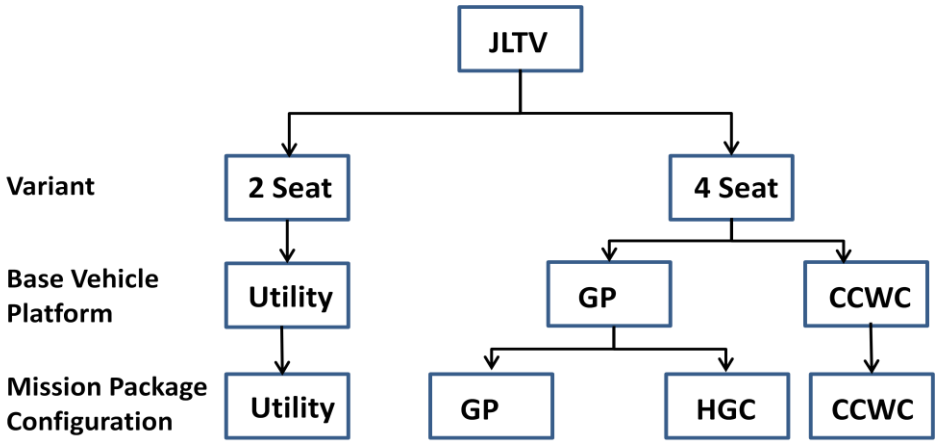

Figure 1: System Diagram

The four-seat base vehicle platforms are further decomposed to specific mission package (MP) configurations. The GP vehicle may be used as a four seat utility vehicle, and may also be configured as a Heavy Guns Carrier (HGC). The HGC can accommodate crew served light machine guns and grenade launchers. The other mission package, the CCWC, carries the Tube-launched, Optically-tracked, Wire

command data link, guided missile improved Target Acquisition System (TOW-ITAS) or the Saber (USMC), and the M2 .50 caliber machine gun.[25]

Requirements

It is important to discuss requirements when trying to identify challenges in a program. In all instances, requirements translate directly to cost. It is difficult to defend a program where the cost drivers/requirements are continuously changing and are perceived as unstable. In the case of the JLTV, requirements changed significantly from one requirements document to the next. However, these changes represented both good and bad on behalf of the program. Initially, the changes added to the difficulty of executing the program. Later however, they were undeniably necessary to drive down cost and decrease technical risk. The changes in requirements that occurred between December 2007 and August 2012 caused the AUMC to decrease as a result of innovative systems engineering analysis and cost reduction efforts.[26]

Comparison

The capabilities documents that were used during Concept Development and TD phase included six different categories of requirements. They were payload, Variant/configuration, protection, weight-range, reliability and cost. We will look at each category as related to the particular version of the capabilities development document current at that time. The Capabilities Development Document (CDD) changed over time as a result of a process known as the Requirements Management and Analysis Plan (RMAP) process. This process added systems engineering rigor o the development of

requirements. In 2006, the Initial Capability Document (ICD) was being used as the current requirements document. The next relevant requirements document published was CDD version 2.7a, published for the TD phase in December of 2007. Upon exiting the TD phase in May, 2011, CDD version 3.3 was published and CDD version 3.6 was later published for entry into the EMD phase in August, 2012.[27]

The first category for review is payload. Payload is related to the number of passengers in each of the variants. In the ICD, there were four payload options, but by the time CDD version 3.3 was published, payload options had been reduced to only two. From that point forward the CDD version 3.3 dropped the payload verbiage replaced it with variants. From that point on there were only two required variants, a two-passenger and four-passenger. The two variants that appeared in CDD version 3.3 now had requirements for configurations. Configuration refers to the different types of mission packages that will be installed into each of the two variants. CDD version 3.3 required six configurations, and was reduced to four configurations in CDD version 3.6.

Protection refers to the amount of blast the vehicle could withstand based on structural reinforcements to the under and side body. Here, requirements for protection doubled from the ICD through CDD version 3.6.

Weight range referred to the amount to vehicle could weigh fully burdened with mission package equipment. The weight range started with a maximum weight of 30,000 pounds and was reduced to a maximum 21,000 pounds over time and across the other three requirements documents.

The next requirement is reliability. It is measured in Mean Miles Between Operational Mission Failure (MMBOMF). The ICD began with 11,700 MMBOMF and over time was reduced to only 2400.

The final requirement was cost, defined as the average unit manufacturing costs (AUMC). The initial AUMC was $200,000. Research indicated that the initial cost was well below the Independent Cost Estimate (ICE) and Joint Cost Estimate (JCE). Over time, the AUMC was reduced from a high point of $400,000 to its current cost of $250,000.[28]

Issues

The JLTV program was being subjected to a level of scrutiny commensurate with a program that had a history of issues which almost resulted in program termination.

The JLTV program suffered from unstable requirements, an increase in predicted manufacturing cost early in the TD phase. These issues had not yet been fully rectified before the successful completion of the TD phase. They were publically identified by the DAE, John Young, at the beginning of the TD phase, and by the Senate Appropriations Committee just after the successful completion of the TD phase. In both instances, immediate and responsible action was taken to resolve the conflict and preceded with the execution of the program.[29]

JPO JLTV utilized Better Buying Power tenets in the execution of the program. The program sought mature technology with low technical complexity. Requirements were prioritized into tradable tiers, with the highest tier being the list of threshold vehicle key performance parameters which could not be traded. Requirements were tiered so

that vendors could make intelligent trade decisions based on stable requirements, a production price that was set in a robust competitive environment, and a firm fixed price contract vehicle.[30]

John Young was not convinced that by the end of the TD phase, his concerns over the potential lack of maturity of technology, unstable requirements and funding inadequacy had been satisfied. His concerns were not strictly related to the JLTV program. They were the manifestation of many major programs being initiated without truly understanding the technical risk involved, a full appreciation for stable requirements and an adequate way to estimate development and procurement costs. Therefore, he directed that all programs requiring DAE approval would now include competitive prototyping with participation from two or more defense contractors entering separate bids. The JLTV program was in fact the first Acquisition Category (ACAT) 1 program to be required to comply with Mr. Young's new directive.[31]

Requirement Management and Analysis Plan (RMAP)

In response to Mr. Young's concerns and directives, the JLTV Combat Development Team led by the Marine Corps at PEO CS CSS developed a process that provided a technically sound and organized structure to incrementally refine the draft CDD in an efficient, methodical and transparent fashion during the TD phase. The process is referred to as the Requirement Management and Analysis Plan (RMAP). RMAP is a process owned by the Combat Developer. It greatly improves the understanding of the feasibility, maturity and affordability of existing technology for both the Combat Developer and the Program Manager (PM).[32]

RMAP is a systems engineering centric event driven process. It allows the Combat Developer and the PM to identify critical events during the TD phase that mark specific points in time where a predetermined accumulation of data has occurred that must be reviewed for relevance and validity and potentially acted upon. These specific points in time or events are called Knowledge Points (KP). A KP may normally be aligned with major test events, design reviews, or results of other analysis that occur during the TD phase.[33]

RMAP is managed by an integrated project team (IPT). Through the use of KPs, the IPT can address issues and conduct any required analysis relatively soon after they occur. Once the analysis has occurred, the IPT can then debate the results and make informed decisions on the issue. The flexibility built into the process allows for issues to be triaged so that the IPT can debate and decide the issues only when information is available. That means that decisions and/or trades are always informed by data born from sufficiently scaled tests or analysis and not anecdotal evidence. [34] Although fluctuating requirements have frequently been called out as evidence of program risk in other acquisition programs, as applied in the case of JLTV, the deliberate and analytical adjustment of requirements in light of demonstrated performance and technical risk, ultimately served to lower program risk and drive down cost instead. The closely managed, systems engineering centric and incremental refinement of the draft CDD continues throughout the entire TD phase. In the end, you have a feasible, mature, and potentially more affordable and stable set of requirements resident in an updated CDD.

Cost-Informed Trades Analysis (CITA)

In the fall of 2011 the Senate Appropriations Committee made public their intent to cancel the program because of costs and unstable requirements. JPO JLTV recognized early in 2011 that even though they had successfully completed the TD phase, the AUMC was still too high. The RMAP was the formal capabilities development process used to refine the draft CDD during the TD phase. JPO JLTV devised a simple process that identified the critical required capabilities, possible solutions and the approximate cost of each alternative. The process was called the Cost-Informed Trades Analysis (CITA). This process allowed the PM to quickly assess lower-cost options that would satisfy capability requirements utilizing industry partner engagements. This process also afforded the vendor to make trade decisions in an effort to lower costs. Because this process was being conducted in a competitive environment with three competitors, the vendors were very cognizant of capabilities vs. cost when opting for less costly options that satisfied the requirement. This meant that vendors would make trade decisions that would provide the absolute best combination of capabilities at the best possible price. JPO JLTV also entered into an agreement with the combat developer to keep him informed of updates for the CDD in order to maintain stable requirements.[35]

At the end of the TD phase, the AUMC was still above the $300,000 mark. JPO JLTV had to determine what the Services could afford to produce and at which price point. It was determined that $250,000 per vehicle was affordable, which now required the JPO JLTV to solicit help from his industry partners to determine if they could build the vehicle that the Army needed at that price. JPO JLTV met with the three vendors to

discuss the $250,000 cost target. After much discussion and the flexibility afforded the vendors in the CITA process, they unanimously concurred that they could in fact provide the base vehicle at a cost of $250,000 even in the highly competitive environment. The $250,000 cost target was formally established at the MS B decision. JPO JLTV now indicates that vendors may be able to beat the $250,000 cost target, if only by a little.[36]

Technology Demonstrations

Development of the Future Combat System (FCS) was in full motion during this period in time. It was promoted as the future of Army brigades. They would be equipped with truly next generation technology that would change the dynamics of the battlefield forever. The Army used events like the Advanced Concept Technology Demonstration (ACTD), now referred to as the Joint Capability Technology Demonstration (JCTD), to ferret out highly developed capabilities and emerging but mature technology. This process, considered to be a pre-acquisition event, normally concluded in one of three outcomes. First, the item might formally be established as a new program. Second, the technology may be integrated into an existing program, or third, the technology could be rejected in favor of more development. Combined with the RMAP and CITA, the JCTD continues as an excellent source of new technology options aimed at filling existing capability gaps. [37]

Strong Industry Involvement

To further ensure success of the program, JPO JLTV embarked on a non-programmatic endeavor that brought senior military leadership together with defense

industry leaders in an effort to form a mutually beneficial partnership in the spirit of transparency and cooperation. In November 2012, JPO JLTV hosted an “Industry Day” where the Assistant Commandant of the Marine Corps (ACMC), the Vice Chief of Staff of the Army (VCSA) and 11 Defense-sector corporations were in attendance. The purpose of the meeting was to first demonstrate unwavering commitment to the JLTV program. Second, they wanted to establish a partnership that would be informed by the realization that budgets are limited and that they knew the EMD phase would include full and open competition with contract awards to multiple vendors and a further down-select competition to a single vendor for the production phase. With that in mind, and with open and frank discussions during the meeting, everyone in attendance understood that it was in the interest of all parties involved for industry to come to the table with their best possible price. The meeting was characterized as a tremendous success. This type of meeting may not be written into doctrine or into other policy documents for immediate execution. However, it certainly allowed senior leaders in both the military and private sector to understand each other’s positions and set the tone for future exercises in cooperation.[38]

Summary

The JLTV program experienced programmatic difficulties that nearly resulted in termination of the program. The stated problems were unstable requirements and a difference in the perception of affordability, which were identified at the beginning of the TD phase and at the end respectively. In my estimation, the overarching actions taken

that led the Senate Appropriations Committee to reinstate funding and a successful transition to the EMD phase are the following:

• Utilization of the Requirement Management and Analysis Plan (RMAP) during the TD phase

• Establishment of the Cost-Informed Trades Analysis (CITA) as a parallel Materiel Developer requirements refinement and cost management effort

• Strong industry participation

RMAP is a proven process that introduces deliberate systems engineering rigor and provides for a structured review of technical data and analysis during the TD phase. It also allows Combat Developers to make informed decisions regarding requirements and a high potential for driving down costs.

The Cost-Informed Trades Analysis (CITA) is a proven process that establishes trade-space between capabilities and cost. It allows the PM to consider and implement lower-cost options to satisfy requirements and achieve cost targets.

Strong industry participation in the competitive process allows industry partners to gain tremendous insight, make responsible and informed trade decisions, remain competitive, and provide the best possible prices to the government.

Recommendation

The Department of Defense should strongly consider institutionalizing both the Requirement Management and Analysis Plan (RMAP) and the Cost-Informed Trades Analysis (CITA) processes. Further, the JLTV program has proved that using mature technology with low technical complexity, prioritizing requirements into tradable tiers,

setting the production price prior to the EMD phase in a competitive environment and utilizing the firm fixed price contract are directly related to program success.

Endnotes

[1]COL David G. Bassett, "Joint Light Tactical Vehicle Defense Acquisition Board Review," briefing slides, Washington DC: assistant secretary of the Army for acquisition, logistics, technology, 9 August 2012.

[2] U.S. Department of the Army G8,*The Army Tactical Wheeled Vehicle Strategy-2010* (Washington D.C: U.S. Department of the Army G8, August 13, 2010, 1,7,8.

[3]Army-Technology.com, "HMMWV (Humvee) High-Mobility, Multipurpose Wheeled Vehicle, United States of America," http://www.army-technology.com/projects/hmmvv/ (accessed 6 March, 2013)

[4]"XM1109/M1109 HMMWV Up-Armored Armament Carrier," linked from *The Globalsecurity.Org Home Page,* http://www.globalsecurity.org/military/systems/ground/m1109.htm (accessed 8 January, 2013).

[5]Ibid

[6]Jacques S. Gansler, "Acquisition of Mine-Resistant, Ambush-Protected (MRAP) Vehicles: A Case Study" briefing slides, School of Public Policy, University of Maryland, NPS Acquisition Research Symposium, May 12, 2010.

[7]Staff Writer, "Fragmentary Armor (Frag) Kits," linked from *The Globalsecurity.Org Home Page,* http://www.globalsecurity.org/military/systems/ground/frag-armor.htm (accessed 8 January, 2013).

[8]"Military HMMWV Variants," linked from *The Olive-Drab.com Home Page* at Military HMMWV Variants, http://olive-drab.com/od_mvg_hmmwv_variants.php (accessed 4 Feb, 2013).

[9]COL David G. Bassett, "JLTV Milestone B Defense Acquisition Board," backup briefing slides with scripted commentary, Washington DC: The Pentagon, August 9, 2012.

[10]Jacques S. Gansler, "Acquisition of Mine-Resistant, Ambush-Protected (MRAP) Vehicles: A Case Study" briefing slides, School of Public Policy, University of Maryland, NPS Acquisition Research Symposium, May 12, 2010.

[11]Andrew Feickert, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, June 6, 2008), 1.

[12]Ibid.

[13] Jacques S. Gansler, “Acquisition of Mine-Resistant, Ambush-Protected (MRAP) Vehicles: A Case Study” briefing slides, School of Public policy, University of Maryland, NPS Acquisition Research Symposium, May 12, 2010.

[14] Andrew Feickert, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, June 6, 2008), 3.

[15]Ibid.

[16]Staff Writer, “The Army Tactical Wheeled Vehicle Strategy,” January 28, 2011, linked to the U.S. Army home page at “Stand-To,” http://www.army.mil/standto/archive/2011/01/28/ (accessed December 13, 2012)

[17]Scott R. Gourley, “The Army’s Tactical Wheeled Vehicle Strategy,” *Army Magazine*, September 2006, 82, 84; Staff Writer, “Army Tactical Wheeled Vehicle Strategy,” July 2006, linked to the AUSA home page at “Torchbearer Campaign,” http://www.ausa.org/publications/torchbearercampaign/torchbearerissuepapers/Pages/default.aspx (accessed December 13, 2012)

[18]Scott R. Gourley, “The Army’s Tactical Wheeled Vehicle Strategy,” *Army Magazine*, September 2006, 82, 84.

[19]U.S. Department of the Army G8, *The Army Tactical Wheeled Vehicle Strategy-2010* (Washington D.C: U.S. Department of the Army G8, August 13, 2010, 1,7,8.

[20]Ibid.

[21] Andrew Feickert, *Joint Light Tactical Vehicle (JLTV): Background and Issues for Congress,* RS22942. Washington, DC: U.S. Library of Congress, Congressional Research Service, February 4, 2013. https://www.fas.org/sgp/crs/weapons/RS22942.pdf (accessed February 22, 2013)

[22]Ibid.

[23]Ibid.

[24]Ibid.

[25]Ashley John-Givens, “Army Drives Ahead with Joint Light Tactical Vehicle Program,” January 26, 2012, linked to the U.S. Army home page at “Article,” http://www.army.mil/article/72533/Army_drives_ahead_with_Joint_Light_Tactical_Vehicle_program (accessed or February 25, 2013); Tamir Eshel, “JLTV Program Enters the Final Round,” August 24, 2012, linked from *Defense-Update* homepage at “JLTV-EMD,” http://defense-update.com/20120824_jltv_emd-2.html (accessed February 25, 2013).

[26] Department of the Army, *Capabilities Development Document for Joint Light Tactical Vehicle v3.6 (JROC Approved): JLTV Concept of Operations*, (Washington, DC: Department of Defense, January 6, 2012), 5.

[27] COL David G. Bassett, "JLTV Milestone B Defense Acquisition Board," briefing slides with scripted commentary, Washington DC: The Pentagon, August 9, 2012.

[28]Ibid.

[29]Ibid.

[30]LTC Brian E. Watson, Army National Guard, Executive Officer, Joint Program Office Joint Light Tactical Vehicle, interview by author, Warren, MI, December 15, 2012

[31]Ibid.

[32]Mark Pflanz, Chris Yunker, Friedrich N. Wehrli and Douglas Edwards, "Applying Early Systems Engineering,"*Defense Acquisition Review Journal*, October 2012,Volume 19, Number 4,422-442.

[33]Ibid.

[34]Ibid.

[35] LTC Brian E. Watson, Army National Guard, Executive Officer, Joint Program Office Joint Light Tactical Vehicle, interview by author, Warren, MI, December 15, 2012

[36]Ibid.

[37] "Joint Capabilities Technology Demonstration (JCTD) " https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=a8c04f0f-91f7-4f65-aeba-ab166c6819b4 (accessed March 4, 2013).

[38] LTC Brian E. Watson, Army National Guard, Executive Officer, Joint Program Office Joint Light Tactical Vehicle, interview by author, Warren, MI, December 15, 2012.